SK 361
.A2F4
67

LIBRARY
FISH & WILDLIFE SERVICE
PACIFIC OCEANIC FISHERY
INVESTIGATIONS

United States Department of the Interior
Fish and Wildlife Service

Fishery Leaflet 67

Chicago 54, Ill. * July 1944

THE TOP MINNOW, GAMBUSIA - THE MOSQUITO DESTROYER

Species and range. There are several species of Gambusia in the United States, Mexico, and Central America, but the ones with which we are chiefly concerned in mosquito control are the species found in our southern States east of the Rocky Mountains and ranging northward from the Mexican boundary to Delaware, southern Illinois, and Indiana. The Mississippi Valley species is known as Gambusia affinis, while the Atlantic slope form is designated Gambusia holbrooki. There is evidence that the top minnow of southern Florida is a different species, and in southern Texas there is still another Gambusia.

These top minnows are inconspicuous little fishes, generally light olive in color; each scale is dark-edged, and there is frequently a fine dark line along the sides, sometimes a dark blotch below the eye; a dark purplish blotch is usually present on the side above the vent in the female; the dorsal fin has two or three transverse rows of fine black spots, the anal in the female is dark-edged; the caudal, or tail, has 3 or 4 irregular transverse rows of dark spots; the other fins are dusky. These fishes vary in coloration according to the character of their habitat; examples from ditches and drains are usually very pale, while those from dark-colored water of swamps are dark green, with a distinct purple bar below the eye. Among Gambusia holbrooki from Georgia and Florida there is found occasionally a variety in which the males (very rarely, the female also) are black spotted, varying from a few black spots generally dispersed over the body to examples which are almost if not entirely black. This variety has been cultivated in aquaria and is now readily obtainable from dealers in aquarium fishes.

The females reach a length of about 2-3/8 inches, while the males average about 1-1/2 inches. The body is elongate, deeper in the female; the mouth is of moderate size, and both jaws are furnished with a band of immovable pointed teeth. The scales are large in proportion to the size of the fish and the fins are small; the anal fin in the male is modified into a sexual organ.

Gambusia inhabit all kinds of sluggish and standing water, whether fresh or brackish, clear or muddy, deep or shallow. Although frequenting deep water, at least when large fish are not present, they show a distinct preference for shallow water and are frequently seen in water too shallow to completely cover their bodies. They thrive in ponds visited by cattle, horses, and hogs, also in weak to moderately strong sewerage escaping from city mains;

they are found alike in open water and in that which is overgrown by vegetation, and even withstand a small amount of chemical pollution. They survived in ditches at Savannah, Georgia, receiving the wastes from a "guano" factory which killed such hardy species as the common fresh-water eel, the mudfish or bowfin, and catfishes. Gambusia, however, endure less chemical pollution, particularly acid, than such species of mosquitoes as Anopheles crucians, Aedes sollicitans and some species of Culex. They have been introduced into cisterns, water tanks, potholes, barrels, and aquaria, where they have lived for long periods of time. They are easily caught with dip-nets, or with a bobbinet seine about 10 feet long and 4 feet deep.

Food and feeding habits under natural conditions and in aquaria. Gambus in addition to living under the wide range of conditions under which mosquitoes propagate, have the very fortunate habit, for the purpose of mosquito control, of seeking their food at the surface of the water, where the immatur mosquito spends most of its life and to which it must come for air. They will take food from the bottom only when it is not available elsewhere. They show a preference for live food, but will eat small pieces of meat of all kinds, also bread and cracker crumbs, hard-boiled egg, etc. Those foods are taken in their natural habitat, as well as in aquaria. Insects and insect larvae constitute a large part of their food; they have a large capacity for food consumption, and it is not unusual for one fish in the aquarium to eat over 100 large mosquito larvae in one day. The number of mosquito larvae which one fish may consume at one time, of course, bears a direct relation to the size of the fish, and a large female, 2-1/3 inches long, has been know to take within one hour 225 large immature mosquitoes; a large male 1-1/4 inches long was able to consume only 28 larvae.

Owing to the highly cannibalistic nature of Gambusia it is extremely difficult to grow them in aquaria. It has been found necessary to separate the young from the adults immediately after birth, for the mother frequently devours her own young as rapidly as they are born. Running water is not necessary; in fact, better results have been obtained in balanced aquaria containing living plants, and particularly algae.

Reproduction. Gambusia are viviparous fishes and reproduce very rapidly. The eggs are fertilized and hatched within the body of the female and the young are brought into the world well developed and alive, and measuring from 3/10 to 2/5 inch in length. Even at birth they are fitted to begin the destruction of mosquito larvae, which when first hatched are thread-like creatures almost microscopic in size.

The female has broods of young throughout the summer at intervals of from 3 to 6 weeks, the length of the breeding season varying with the latitud and somewhat with the weather conditions of different years. The breeding season, for example, begins about the middle of May and ends near the middle of September at Beaufort, N. C.; at Augusta, Ga., it begins about the 1st of May and ends the first of October; while at Key West, Fla., breeding occurs at all seasons, although gravid females are much less numerous during the winter than during the summer.

The number of young produced at one time varies greatly, ranging from a few to a couple of hundred. The average number of young to a brood, however, probably does not exceed 40, the number usually varying with the size of the female, i.e., a small female gives birth to a smaller brood than a large female. The young fish grow rapidly and become sexually mature in the aquarium at the age of about 4 months, and quite probably in a shorter time under favorable conditions in their natural habitat. In aquaria one female during a single season had as many as 345 offspring, consisting of two generations.

Like some other live bearing fishes of the family Poeciliidae, female Gambusia remain fertile for several months or longer, and produce four or more broods after separation from the males; in this case, however, the broods decrease in number of individuals at each birth. As the males succumb to adverse conditions more easily than the females, this extended fertility in the females sometimes provides for restocking without the necessity of obtaining new males.

Degree of mosquito control obtainable with Gambusia. It has been the experience of this service that in general 100 per cent mosquito control has not been obtained by the use of Gambusia when plants and floatage are present to provide hiding places for mosquito larvae.

The number of top minnows necessary in a body of water in order to secure mosquito control depends largely upon the conditions which prevail with respect to places of protection, i.e., a much smaller number is necessary if the water is fairly free of hiding places for mosquito larvae against fish, than if the reverse is true. For a pond of about 5 acres in area it would be difficult to have too many top minnows, especially if the stock, as in northern regions, is not self-maintaining, and any number from 3,000 to 10,000 might be introduced.

Breeding Gambusia in the southern States of this country has been highly successful in small to moderate-sized ponds or swamps. Stock ponds visited daily by horses and cows have yielded remarkably good results. Heavy reproduction also has resulted in shallow ponds or swamps containing an abundant growth of plants. It is highly essential, of course, that such ponds should be free from fishes, snakes, and other animals that would prey on minnows. Reproduction in small ponds may be stimulated by artificial feeding. For this purpose fish or any red meat that has been through a food chopper may be used; bread and biscuits also have been used to advantage. If it is found necessary to breed the fish in containers, large shallow tanks with many obstructions and with green plants might give good results. The association of goldfish or other larger fish with Gambusia in aquaria is not recommended, as goldfish will destroy the young within a very short time. In out-of-door ponds stocked with goldfish and Gambusia, the latter will multiply, while there will be no increase in the goldfish.

Gambusia in the northern States. It is unfortunate that Gambusia generally do not endure the winters north of Delaware, southern Indiana and Illinois and, therefore, can be used in that section of the country only on a small scale.

Dr. J. Percy Moore of the University of Pennsylvania made for the former Bureau of Fisheries an investigation on the value of various fishes for the control of mosquitoes and reported that no fish to which mosquitoes are more than an incidental item of diet had been found in the fresh waters of the northeastern United States. He found also that these fishes are more detrimental to culicine, the non-malaria mosquitoes, than to the anopheline species which carry the malaria organism. Dr. Moore suggested that a brood stock of several hundred Gambusia may be kept in a greenhouse through the winter, and planted outside in April or May when the water reaches a temperature of about 60 degrees F. These may increase to several thousand by August, when mosquito larvae are becoming plentiful. This practice could be carried out in any community; all that is required are a small seine, a couple of milk cans, and several tubs or half barrels kept in a greenhouse. Anyone familiar with the management of an aquarium can feed and care for the brood stock during the winter.

Some success has been attained, since Dr. Moore made the investigation mentioned, in keeping Gambusia alive in ponds during the winter in the vicinity of Chicago. It may be that a hardly cold-resisting variety is being developed.

Gambusia in foreign countries. Since 1918, when the value of Gambusia as a destroyer of mosquito larvae was first clearly demonstrated in the extra cantonement zone of Camp Hancock of the First World War at Augusta, Ga., it has been distributed through the combined efforts of the former United States Bureau of Fisheries and the Fish and Wildlife Service, the League of Red Cross Societies, and other governments, practically throughout the world wherever climatic conditions were favorable. Shipments have gone to the Philippines and to the Hawaiian and Society Islands, to nearly all the countries of southern Europe including Germany, Austria, and Russia, and also to China, Japan, and Siam. The first successful shipment to Europe went to Spain, and from there Gambusia were distributed to points in Italy, and elsewhere in southern Europe. The United States Bureau of Fisheries sent the fish also to Syria and Palestine, the West Indies, and the Argentine.

Nowhere has Gambusia multiplied so enormously as in Italy, where it is reported that standing water in some places has become literally clogged with them, so much so that the peasants complain that the cattle refuse to drink the water. The success obtained in Austria and Italy in the control of mosquitoes through the use of Gambusia is reported to be most gratifying. In June 1927, Dr. Maximus Sella reported that "After four and three years, respectively, from the time of importation of Gambusia into Spain and Italy, we have to thank the United States for the precious gift which they made us, the value of which we no longer doubt." In Palestine, unfortunately, it is said that Gambusia has encountered enemies with which it could not cop

Gambusia in aquaria. Gambusia are among the species which should be kep to themselves in aquaria, as they are vicious, or rather voracious, and nip pieces from the delicate fins of other fishes that may be in the same tank. Guppies will have their tails mutilated and so will goldfish, especially thos with large fins which usually are thin and tender around the edges.

As Gambusia are native to the Atlantic coastal region as far north as Delaware, one does not need to guard them from cold so carefully as fishes from the tropics. Of course, stock from Florida and Georgia could not be expected to stand as much cold as fish derived from points farther north.

Dealers in Gambusia. Gambusia are not among the species distributed free by the U. S. Bureau of Fisheries. Occasionally, however, if a supply is available, they can be sent from convenient stations at the expense of the applicant, the expense embracing the cost of the container used for shipment and the express charges on the fish.

For stocking purposes they may be purchased from the following persons; the service, however, assumes no responsibility in supplying these names.

Everglades Aquatic Nursery, 706 Plaza Place, Tampa, Florida.
Aquarium Supply Co., 3827 Georgia Avenue, N. W., Washington, D. C.
The Southern Biological Supply Co., 517 Decatur Street, New Orleans, La.

Publications relating to mosquito control.

Hildebrand, Samuel F.
Top minnows in relation to malaria control, with notes on their habits and distribution. Bulletin No. 114 of the U. S. Bureau of the Public Health Service, 34 pages, illus., May 1921. (Out of print.)
A study of the top minnow, (Gambusia holbrooki) in its relation to mosquito control. Bulletin No. 153 of the U. S. Bureau of the Public Health Service, 135 pages, illus. 1925. (Out of print

Howard, H. H.
Use of top minnows as an agent for mosquito control. International Health Board, New York, January 1920. 59 pages.

Moore, J. Percy. - Uses of fishes for control of mosquitoes in northern fresh waters of the United States (with literature cited); Appendix 4 to Report of the Commissioner of Fisheries for 1922, 62 pp., 7 pls. Bureau of Fisheries Document No. 923. (Out of print.)

The United States Public Health Service keeps on hand a supply of leaflets and pamphlets on mosquito control and is glad to furnish inquirers such information and literature on the subject as are available.

U. S. Government publications are available for consultation in many of the Public and University libraries of the Country.

February 1935.
Revised July, 1944.